

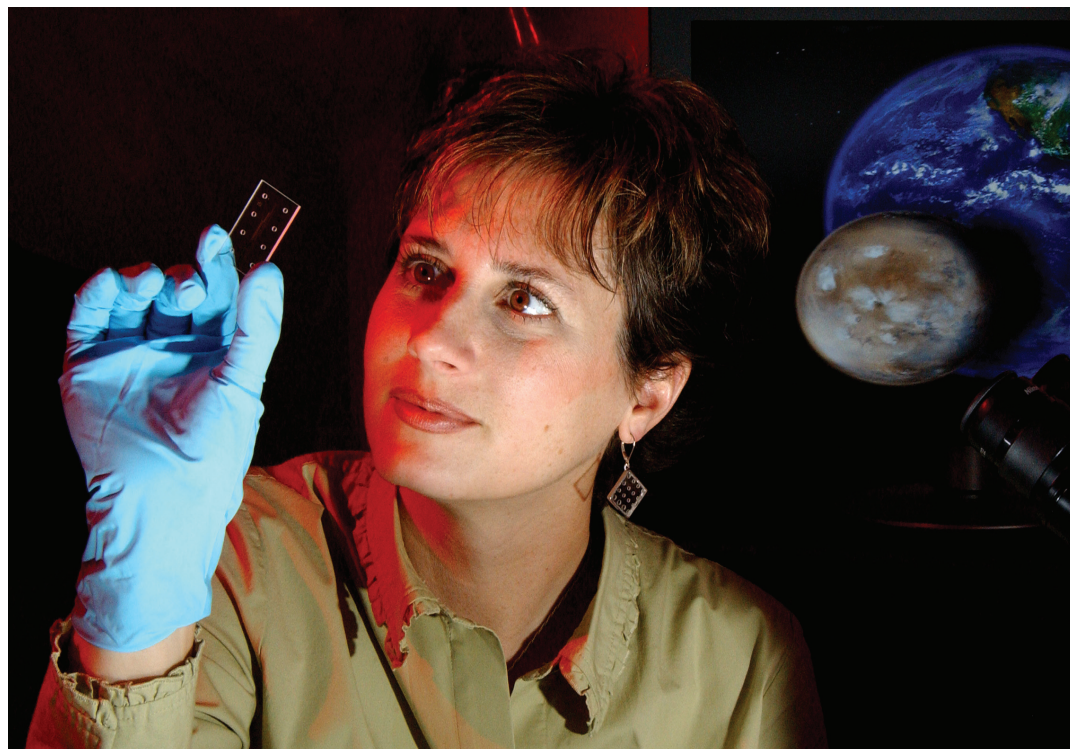
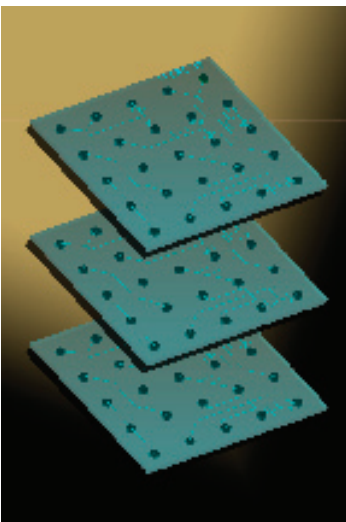
# Lab-On-a-Chip Application Development (LOCAD)



## Impact to Exploration

Long duration missions for space exploration are imbued with the inherent challenges associated with restricted communication and the need to employ crew health testing, environmental and microbial monitoring regimes without access to earth bound laboratories. The Lab-On-a-Chip Application Development (LOCAD) Team is currently developing miniature, portable technology that will offer the versatility of performing biochemical tests to help serve environmental monitoring, crew health diagnostics, search for life on Mars, and planetary protection. Integrating microfluidics and microarray technology, the LOCAD team along with its partners is developing chips and a handheld unit to perform the analyses. As a precursor to this microfluidic platform,

the LOCAD team will leverage off of its experience from flying a commercially available, and modified for flight, off-the-shelf unit on the ISS in 2006. The LOCAD Portable Test System (PTS) will be used by the crew to perform rapid (within minutes) assessment of microorganisms on ISS surfaces and the results will be compared to the commonly employed method of plate culturing (~3 days for analysis). Future plans include the easy adaptation of the unit to perform chemical analyses of substances such as hydrazine. Included among the benefits associated with employing this technology are its low mass, power, and volume and its ability to perform rapid analysis with small sample size, and increased reproducibility and sensitivity.



## Expertise and Partnerships

The team represents 100+ years of expertise in engineering and fabrication of space flight hardware. The team also has significant expertise in the areas of molecular biology, biochemistry, optical design, network fluid flow modeling, systems engineering, and project management.

**Affymetrix** – World's premier nucleic acid microarray developer

**Caliper Life Sciences** – Largest Lab-On-a-Chip (LOC) manufacturer in the world

**Carnegie Institution of Washington** – Expertise in assays and microarray development

**Charles River Laboratories** – Designer of microbial detection units

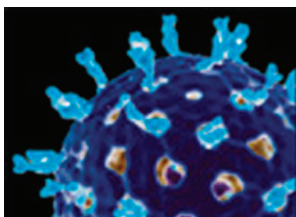
**Marine Biological Laboratory** – Expertise in biological and chemical assay development

**University of Alabama in Huntsville** – Expertise in optics and fluidic modeling

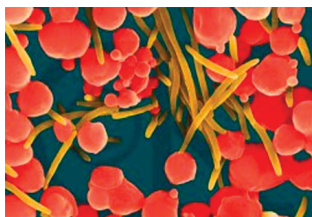
**US.Army AMCOM MEMS & Microdevice Facility** – LOC product development via MSFC/U.S. Army interagency agreement

## Current Work

Development of handheld, portable analyzers and integrated function chips for:



Crew health diagnostics for short duration and extended exploration missions

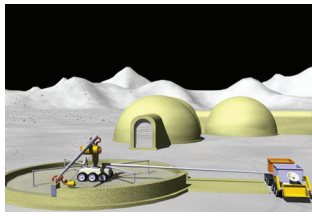


Advanced Environmental Monitoring and Control (AEMC) Program

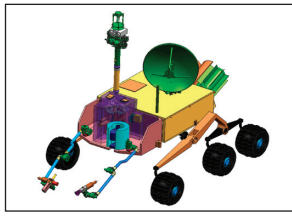
Microbial monitoring of water and air on ISS, the Moon, and Mars for the



Planetary protection to assess forward and backward microbial or chemical contamination



External environmental monitoring of crewed habitats



Robotic exploration to search for life on Mars

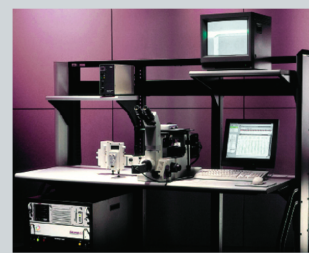
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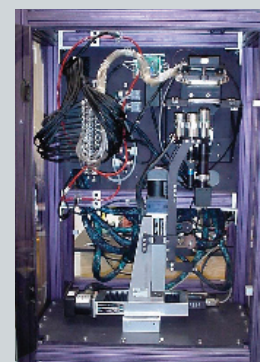
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## Caliper 42 unit

- Controls processes on commercial chips to support development of LOC applications (unique to the U.S. Government).
- Fully automated or manual process control; planned web-based
- Controls processes on commercial chips to support development of LOC applications such as microbial detection, water quality monitoring, and biosignature detection on Mars.
- Assortment of COTS chips available to NASA, exclusively through MSFC contract with Caliper Life Sciences



## Application Development Unit (ADU-25)

- Developed and fabricated at MSFC
- Only facility of its kind; key to developing integrated chip products
- Modular by design, fully reconfigurable for future on-chip biological and chemical process detection and analysis techniques
- Proof-of-concept facility for developing hand-held LOC control and analysis units